

# New Results for the Halogen Monoxides and OXO Dioxides

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The halogen monoxides were among the first highly reactive free radicals observed by microwave spectroscopy. There are numerous papers in the literature describing optical, infrared, ESR, LMR, and other spectroscopic studies of these molecules. More recently, the role of the halogens in upper atmospheric processes resulting in ozone depletion has resulted in further interest in the properties of their oxides. As part of a continuing effort at JPL to provide a database for rotational spectroscopic observations of the upper atmosphere, we have extended the range of observations of ClO, BrO, and IO. In the process of these investigations, we discovered that we were able to generate IO and BrO in highly excited vibrational states,  $v = 13$  in  $X_1^2\Pi_{3/2}$  and  $v = 9$  in  $X_2^2\Pi_{1/2}$  for IO and  $v = 8$  in  $X_1^2\Pi_{3/2}$  and  $v = 7$  in  $X_2^2\Pi_{1/2}$  for BrO. In addition, we used  $^{18}\text{O}$  enrichment to observe the isotopically substituted molecules. For ClO the excitation mechanisms which were effective in the heavier oxides do not seem to occur. However, ClO is generated in high yield and we were able to observe  $v = 2$  spectra at thermal populations and  $^{18}\text{O}$  spectra in natural abundance.

OIO was discovered as a byproduct of the IO reactions. These were the first high resolution observations of OIO. As is the case for OCIO and OBrO, OIO has a  $^2B_1$  ground electronic state. Both the ground vibrational state and first excited bending state spectra of the  $X^2B_1$  state have been analyzed. Thus, precise molecular parameters are now available for the series of compounds, OCIO, OBrO and OIO.

In this poster, we report the more important molecular parameters that describe these spectra and the derived molecular properties.

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